

LADYBIRD POPULATION EXPLOSIONS

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This paper has been prompted by two recurring features of the last ten years, during which time we have co-ordinated a nation-wide survey of ladybirds in Britain. One involves the phone calls we receive from members of the media, almost every year in late July, or early August, asking us to comment on 'plagues of ladybirds' that have hit such-and-such a place. The second involves the commonest ladybird reminiscence of members of the public whom we have met while travelling around Britain either looking for, or talking about ladybirds: "the year that ladybirds went mad". Almost all are remembering the last 'great ladybird year'—1976; although a few also recall the preceding one, in 1959. Much has been written in the press, both local and national, about plagues of ladybirds, their causes and effects. A considerable proportion of these column inches is ill-informed. The impression we often get when talking to journalists is that their aim is to write something that is worth printing, even if it means making a proverbial mountain out of a molehill. In our opinion this is something of a shame, as regular and often exaggerated reports of natural phenomena, which are a little out of the ordinary, undoubtedly devalue reports of truly extraordinary natural phenomena. Ladybird 'plagues' provide an excellent example, for major ladybird population explosions are truly amazing events.

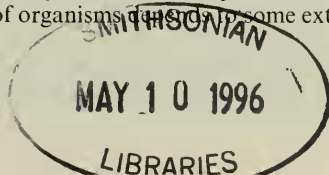
Ladybird plagues, whether widespread or local, are well-known natural phenomena. Records of swarms are scattered widely through the literature over the past century. In this paper we give an account of some of the reminiscences of the most recent major ladybird population explosion in Britain, that of 1976, put on record some of the sightings of ladybird swarms between 1984 and 1995, and comment on the causes and consequences of ladybird swarms.

THE 'GREAT LADYBIRD YEAR'—1976

The population explosion of ladybirds in 1976 was truly astounding. It extended across more or less the whole of England and Wales, and into some parts of southern Scotland. Exceptional numbers of ladybirds were also recorded in many parts of north-west Europe. The huge numbers of ladybirds were widely reported in newspapers, and on television and radio. In Appendix 1 are listed a small sample of the many reports and reminiscences of the plagues of ladybirds that year.

Rapid increases in the size of ladybird populations are due to a combination of factors rather than a single one. Principal among these are food availability, sunshine during the early summer, temperature during the middle of the summer, and the mildness of the preceding winter. Other factors, such as the abundance of parasitoids of ladybirds, also play a role. The way some of these factors fit together may be understood by considering the prevailing conditions prior to the population explosion in 1976.

The summers of both 1975 and 1976 were unusually warm and sunny. Because the extent of any change in the size of a population of organisms depends to some extent



on the base number of individuals, it is pertinent to start in the summer of 1975. This was a long warm summer, not exceptionally dry or hot, but with warmer temperatures than average and no significant long periods of bad weather. Both aphids, and the ladybirds that fed on them, did well. At least some species of ladybird such as the 2-spot *Adalia bipunctata* (L.), 7-spot *Coccinella septempunctata* L. and 10-spot *Adalia decempunctata* (L.) produced a partial second generation. Consequently, by the autumn of 1975, the populations of aphidophagous ladybirds that retired to their overwintering refuges were already larger than usual. The ensuing winter was remarkably mild, with a result that the winter mortality rate of ladybirds, which is usually in excess of 50%, was much lower than this figure, thereby increasing the number of ladybirds in the spring of 1976 still further, relative to the norm.

The spring of 1976 was not exceptional. If anything it was wetter and warmer than average. Aphid populations did well, reproducing rapidly on the lush plant growth, so that when ladybirds began to venture out in search of food, they found plentiful supplies. Cloudy weather in April and early May prevented most species from indulging in much mating early on, but when the sunny weather began in the middle of May, conditions were ideal. The ladybirds began to mate and oviposit at a very rapid rate. Larvae found plentiful supplies of aphids and, as temperatures rose to record levels, they fed up and completed their development in an abnormally short time for Britain. The hot sunny weather continued day after day through the rest of May and throughout June. By the end of June, the extent of the increase in ladybird numbers, in England, Wales and southern parts of Scotland, was already evident. They were everywhere. The species that showed the greatest increases were the aphidophagous generalists, such as the 7-spot, 2-spot and 14-spot *Propylea quattuordecimpunctata* (L.), but most other species did better than usual and 10-spot, 11-spot *Coccinella undecimpunctata* L. and cream-spot ladybird *Calvia quattuordecimguttata* (L.) were more abundant than we have seen them since.

This increase in the number of adult ladybirds, combined with the huge densities of ladybird larvae among aphid colonies (and high densities of other aphid predators and parasitoids) led to a dramatic crash in aphid numbers. Bluntly, the aphids were massacred. Even with their phenomenal reproductive rate, the aphids could not keep up with the losses due to predation. Worse still, the plants that the aphids were feeding upon were deteriorating rapidly under the scorching heat of that long hot summer.

By the middle of July, the aphids on the ladybirds' normal host plants had, more or less, been eaten out. The ladybirds then began to search for food elsewhere. They took to the air in huge numbers, billions upon billions of them. Some found food on unusual host plants, but the aphid populations there were soon decimated as well by the sheer weight of numbers of hungry ladybirds. Day after day, in the second half of July and on into August, the great swarms of ladybirds took to the air as the temperatures rose in the mornings. They flew hither and thither, partly being carried on the prevailing winds, until they came to the coast. Here they stopped, being brought to earth by the air currents at the coast and possibly by a reticence to cross wide expanses of water. Vast numbers were reported along all the coasts of England and Wales, with the south and east coasts being most affected.

The numbers of ladybirds were so legion by the end of July, that they drove holiday makers from the sea-side resorts. There were many reports of them 'stinging' or biting humans, although, in truth, all the starving beetles were doing was trying to find food. In their desperation, they tested the edibility of anything that might have been nutritious to them. They did not find humans palatable, but their attempts to

test whether we were edible left many people with little bite bumps as our own chemical defences reacted to the minute droplets of pre-digestive enzyme that ladybirds inject into their prey when they bite. Untold millions fell into the sea, or were washed off the coastal sands, muds and rocks as the tide rose and fell. Many were washed back onto the coast by ensuing tides, so that the tide-line appeared to comprise little but the corpses of ladybirds.

We once calculated the approximate number of ladybirds that would have been in the tide-lines along the southern and eastern coasts of Britain on a single day in late July 1976. Assuming all to have been one of our larger species, the 7-spot (which they were not), a conservative estimate gives a figure of some 23 654 400 000 ladybirds (estimated by counting the number of 7-spots in 15 200 mm sections of tideline and multiplied up by the amount of suitable coastline between Land's End and the east coast border between England and Scotland). This figure is difficult to comprehend, but it is about four times the current human population of the Earth and, of course, this was just the ladybirds in the tide-lines on a single day. It does not include any of those that stayed on land, or those that were washed out to sea, or those that were eaten by other starving ladybirds or other predators, or those that were killed on the roads or elsewhere by the devices of man. Not surprisingly, a crash in ladybird populations followed.

From this description, it may be seen that a whole sequence of conditions are involved in the run up to one of the great ladybird explosions: favourable conditions the previous year, a mild winter, plenty of food in the spring, a single and synchronized start to the reproductive season brought on by a sharp improvement in sunshine hours, and hot and sunny weather in the summer to promote mating, egg laying and rapid larval development. It is not often that all these conditions fall together, with the result that widespread ladybird explosions are rare in Britain, occurring, on average, about once every 15 years. We seem to be overdue for one now.

RECORDS OF LADYBIRD 'PLAGUES' IN BRITAIN: 1984-1994

During the Cambridge Ladybird Survey, we have received many reports of abnormal numbers of ladybirds being seen together. A few samples of these records are given in Appendix 2, together with notes on the observations culled from the reports sent in by recorders. The records come from two main periods of the year: the early spring, and what might be termed high summer, covering the last two weeks of July and the first two weeks of August.

The reasons that large numbers of ladybirds tend to be observed together in these two periods are different. Many species of ladybird aggregate together to pass the winter. Large numbers of individuals may find the same sheltered area out of the worst of the winter weather. When these first venture out from their overwintering sites they will often do so en masse. On bright spring days, ladybirds will often sun themselves to warm up. This means that large numbers will be seen in exposed positions sunning themselves before moving off to forage for food. Most of these spring records involve the 7-spot ladybird which tends to overwinter close to the ground, or occasionally underground, often in large aggregations. On leaving its overwintering sites, this species will first climb low spring vegetation to sun itself, to drink dew or rain drops to replenish its fluid reserves, and to look for whatever food it can find. Here, on low-growing green leaves, it is very obvious and easily seen.

It is in high summer that the largest numbers of ladybirds come together and sometimes form what may realistically be called swarms. At this time of year, the

adult population usually reaches its maximum. The new generation of adults has not yet begun to diminish because of the perils of life: lack of food, predators, parasites, disease, adverse climate or pure accident. The main activity for these young adults is to feed up for the winter. In many years, aphid populations decline dramatically in high summer, partly as a result of predation pressure and partly because their host plants are deteriorating. The consequence is that in areas where food has become scarce, ladybirds will often take to the air on hot summer days, to seek food elsewhere. The direction of ladybird flight is not entirely active. While ladybirds can fly in a direct way, when they take to the air on hot days their flight is aided by thermals. These thermals may take the ladybirds up hundreds, even thousands, of metres into the sky. At high altitude, they are then blown by the prevailing winds, often for many miles. Due to the nature of thermals in some places, and particularly along the coast, large numbers of these high-flying ladybirds may be brought back to earth in the same place, producing very high population concentrations. The prevailing south-westerly winds are thus responsible for the fact that swarms are more often recorded from the east coast of England than any other region.

THE NECESSITY FOR SYNCHRONIZED REPRODUCTION

Most of the factors that appear to be prerequisites for ladybird population explosions are easily understood. Good climatic conditions and high food availability the previous year lead to an increase in the number of ladybirds that feed up well prior to overwintering. The high fat reserves of these ladybirds, and/or a mild winter, will result in reduced mortality during this critical period. Conditions under which aphids flourish in the spring will lead to good supplies of food for the ladybirds when they leave their overwinter sites and begin feeding and reproducing. Warm sunny weather in late spring and early summer will induce high mating frequencies and rapid oviposition. The high aphid density and warm weather will allow rapid larval development and reduce the level of larval cannibalism. All this is intuitively sensible. However, the reason why a single and synchronized start to the ladybird reproductive season is crucial, is not so obvious. It is not easy to see why a somewhat staggered start to the reproductive season would not produce even greater numbers if the start of the season were extended earlier. Surely, one might expect that a staggered start would produce greater numbers because, at least in the early part of the season when aphid numbers are just building up, survival of larvae would not be reduced too much by competition between them.

Three factors appear to be important in reducing the benefit of an early and staggered start to the ladybird reproductive season. First, any significant predation early in the spring may greatly reduce the eventual numbers of aphids produced later in the year. Because aphids have such a phenomenal reproductive potential within a single year, the death of a single female in April may reduce the July population by many millions. Second, as female ladybirds are reluctant to oviposit on plants which are already inhabited by ladybird larvae (Hemptinne *et al.*, 1992), stretching the reproductive season will reduce the number of suitable oviposition sites for females later in the season. Third, and perhaps most crucially, parasitoids of ladybirds may benefit from the presence of immature stages over a protracted period. Monitoring of population demography in 1990 showed the influence that predators and parasitoids may have in years when the reproductive period for ladybirds is staggered.

Records in late 1989 indicated that numbers of several of the generalist species of ladybird were at their highest levels since 1976. The winter of 1989/90 was

exceptionally mild, and winter mortality was low. In East Anglia the 7-spot ladybird was about 20 times more common in the spring of 1990 than it had been in the spring of 1989. Similar reports of unusually large numbers of ladybirds came in from most parts of the country. In May, reports of exceptionally large numbers of aphids were published in the national press. Conditions appeared ripe for a major ladybird population explosion. However, it never materialized on a wide scale.

The winter of 1989/1990 was not only mild, it ended early, producing an abnormally early spring (for the second year running). Ladybirds of many species, including the aphidophagous generalists, began mating and ovipositing more than a month earlier than average. The first 7-spot matings were recorded on 26th February in 1990, compared to an earliest of 21 April during the years 1985 to 1988 inclusive. The progeny of this early bout of reproduction hatched, and because of the mildness of the winter, they found aphid food as the aphids had also begun to reproduce earlier than usual. Larval development was slower than usual because of the lower average temperatures during March and April 1990, compared to May and June in most years when larvae would normally be feeding up. However, the first pupae were recorded in the last week of April 1990, and the first newly eclosed adult appeared on 8th May. By this time, eggs and young larvae were very plentiful, and conditions for their development appeared ideal as aphid population densities were high.

So why did these good early signs not result in the expected population explosion? There were several contributory factors. Some sharp late frosts may have caused some mortality: ladybirds are known to be particularly susceptible to hard early and late frosts. The dulllest June, according to records at Heathrow Airport Meteorological Station, since records began there in 1957, must also have slowed down the reproductive rate of many ladybirds. But neither of these climatic factors could account for the decline in numbers of ladybirds that occurred in late June. Surveys at a number of sites in southern England in May and June showed egg and larval densities to be very high and aphids to be plentiful still. The density of ladybird pupae on nettle-beds at Box Hill, Surrey, in late June, was the highest we have ever seen, with almost every nettle leaf having at least one pupa on it. One leaf had 13, and one single nettle stem had some 126 final instar larvae, pre-pupae, pupae and newly emerged adults upon it. One 550 square metre nettle-bed, in the grounds of Juniper Hall, near Dorking, Surrey supported a population of close on one hundred thousand 7-spots, 2-spots, 10-spots and 14-spots. By this time there were already indications of some cannibalism among the ladybirds as aphid populations began to decline under the burden of predation. But the main reason for the fact that excessive numbers of adult ladybirds never materialized is that the vast majority of pupae never hatched. They were hit by one main predator and two species of parasitoid.

The predator was the bug *Deraeocoris ruber* (L.). Both the nymphs and adults of this bug are predatory, usually feeding on a variety of types of prey. However, in June 1990 they appeared to be specializing on ladybird pupae, probably as a result of the abundance of the pupae and their relative defencelessness against this predator. While it is impossible to give an accurate estimate of the mortality level of ladybird pupae due to attacks by this bug, because of the difficulty of detecting attack marks, the level in June 1990 was certainly over 10% and may have been much higher.

The two parasitoids were the phorid flies *Phalacrotophora fasciata* (Fall.) and *P. berolinensis* Schmitz. These flies attack and kill ladybird pre-pupae and pupae. In 1990, about 60% of 2-spots and 75% of 7-spots were attacked (Disney *et al.*, 1994). These are the highest parasitoid rates of ladybird pupae by phorids that have been

recorded anywhere. The reason that the rate was so high in 1990 appears to be that the progeny of the ladybirds that bred early (in February, March and April) provided the phorids with hosts early in the year, so that they were able to produce an extra generation. The phorids that developed inside ladybird pupae in June/July in such large numbers were the grand-children of those that had overwintered.

A staggered reproductive period thus may allow parasitoids of ladybirds to increase their numbers by increasing the number of generations, to the eventual detriment of their hosts.

Other predators, including later-developing ladybird larvae and lacewing larvae that were running short of aphid food, undoubtedly accounted for still more pupae. In the end, given its early promise, 1990 ended up as a very disappointing year for ladybirds.

To our list of conditions for ladybird population explosions, we must then add that predators and parasitoids of ladybirds must not be abnormally common.

WHICH SPECIES OF LADYBIRDS ARE PRONE TO POPULATION EXPLOSIONS?

The ladybird that is most often recorded in swarms or plagues in Britain is the 7-spot ladybird. This is partly because it is a large and obvious species, and so large increases in its numbers are very noticeable. The 7-spot is also the most abundant British species of ladybird, and so starts from a higher population density base when it does increase in number rapidly. However, the 7-spot is not the only British ladybird that exhibits very rapid population increases. All the aphidophagous species of ladybird that do not exhibit strong host-plant preferences may increase in number spectacularly over a single reproductive season. These species include the 7-spot, 2-spot, 10-spot, 11-spot and 14-spot ladybirds, the cream-spot and Adonis' ladybird *Adonia variegata* (Goeze). All these species exhibit great fluctuations in numbers, although the increases in numbers of Adonis' ladybird and the cream-spot ladybird are rarely noticed as their usual densities are relatively low. All seven of these species lay eggs in clutches on a wide variety of host plants, as long as suitable aphid prey is available. This means that these species can respond to rapid increases in aphid numbers. Furthermore, they can also respond to declines in aphid colonies, which are notoriously ephemeral, by flying to other plant species to seek alternative aphids.

It is pertinent not only to say which species do show large-scale changes in population size, but also to explain why other species do not. In the case of the four species of British ladybird that are not predatory, the explanation of their relative stability in population size is simply a consequence of a relatively consistent food supply. These species, the mildew-feeding 16-spot *Tytthaspis sedecimpunctata* (L.), 22-spot *Thea vigintiduopunctata* (L.) and orange *Halyzia sedecimguttata* (L.) ladybirds and the leaf-eating 24-spot ladybird *Subcoccinella vigintiquatuorpunctata* (L.), are much less subject to the vagaries of the weather than the predatory species. For example, we have monitored orange ladybirds at Box Hill each year since 1987. The timing of the first reported mating of the year has only varied by eight days (9–16 June) over nine summers (1987–1995). Furthermore, the rate of larval development in these species is somewhat slower than that of the aphid-eating species, presumably because mildews and leaves are less nutritious than aphids.

The three British coccid-feeding ladybirds, the heather ladybird *Chilocorus bipustulatus* (L.), the kidney-spot ladybird *Chilocorus renipustulatus* (Scriba), and the pine ladybird *Exochomus quadripustulatus* (L.), do not produce massive

population explosions. This is probably a consequence of three factors. First, their preferred prey, coccids (scale insects) do not increase their numbers as fast as do many species of aphid. Second, there are less species of coccid than aphid, so that should one species of coccid-feeding ladybird increase in number so substantially that it ate out one species of coccid, it would have less in the way of potential alternative types of principal prey (prey that promotes oviposition and allows full larval development, Hodek, 1973). Third, and perhaps most significantly, these three species of ladybird all lay their eggs in batches of just one to three eggs underneath coccids, or adelgids in the case of the pine ladybird, or occasionally in bark crevices close to them. Ovipositing in this way, these species do not have the scope for reacting to particularly favourable conditions as fast as some of the aphid-feeders which may lay batches of several dozen, or in the case of the 7-spot, over a hundred eggs in a single clutch if conditions are right.

Aphidophagous host-plant-specialist ladybirds also rarely produce massive population explosions on a wide scale. Here the reason is again probably related to a lack of a range of different principal foods that would allow these species to maintain a high reproductive output once one prey species began to decline as a result of increased ladybird numbers. In addition, several of the host-plant specialists seem to show obligate univoltinism. For example, in Britain, both the eyed *Anatis ocellata* (L.) and striped *Mysia oblongoguttata* (L.) ladybirds apparently have a requirement of passing through a dormant period during the winter before they will begin to reproduce.

Having said that species other than the aphidophagous generalists do not produce population explosions on a wide scale, we have had records of local explosions for several of these species. These records include abnormally high numbers of larch ladybirds *Aphidecta oblitterata* (L.) in conifer plantations in Suffolk and Perthshire during 1986 and 1989 respectively; very large numbers of pine ladybirds on Scots pines, at Lakenheath Warren and the King's Forest, Suffolk, in both 1985 and 1989; and exceptional numbers of hieroglyphic ladybirds *Coccinella hieroglyphica* L. at Chobham Common in 1985 and 1989. In each case the increase in numbers was probably a consequence of abnormally high local prey densities. In the cases of the increases in larch ladybirds and pine ladybirds, we know this to be the case, high numbers of adelgids being reported on conifers in each instance. In the case of the increases in hieroglyphic ladybirds, we assume that the heather leaf-beetle *Lochmaea suturalis* (Thomson, C. G.), whose larvae appear to be the main food of the hieroglyphic ladybird, must have been having bumper years, although, as we had not at that time recognized the association between these two beetles, we were not monitoring heather leaf-beetle numbers in 1985 or 1989.

CONCLUSION

Dramatic increases in ladybird population numbers are essentially the product of the interaction of three groups of organism: aphids, ladybirds, and the predators, parasitoids and parasites of ladybirds. These interactions are in turn dependent on climatic factors. Relatively minor fluctuations in climate, or in the interactions between these groups at one time of year, can have a greatly amplified effect later in the season. This means that predicting ladybird population explosions is very uncertain, as we found in 1990. However, the past history of reported explosions suggests that, although unpredictable, these events do occur with surprising regularity. For example, if 1996 does not produce a population explosion, the period 1977–1996 will be the longest period without an explosion this century.

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APPENDIX 1.

ANECDOTAL ACCOUNTS DURING THE LADYBIRD POPULATION EXPLOSION OF 1976

“In 1976, on a hot summer’s day, I had occasion to visit an area between Elvedon and Barnham, about one mile south of Thetford, the exact spot being known as the Gorse Trading Estate. I must have been exceptionally lucky, or unlucky, as one of these ‘swarms’ had landed on the road passing through the estate, along which I had to travel. I can remember very clearly seeing the whole road covered in thousands of red ladybirds and the area involved must have been at least 18ft × 20ft. Unfortunately, I had to pass over them.” (Jack Easter)

“In the summer of 1976, my two daughters, who were then 15 and 12 respectively, had to curtail one of their usual summer activities, swimming at Ruislip Lido (Middlesex), because of ladybirds. They did not like going into the water because the surface was covered with millions and millions of ladybirds. The Lido has an artificial beach for the bathers, and the sand was often also thick with ladybirds. I do not know what type of ladybirds they were. Although my daughters are both grown up now, and both have children of their own, I know they still remember 1976, as I have heard them tell their children the story of when ‘ladybirds stopped play!’” (Sally Wheatley)

“In 1976 we had a plague of ladybirds here in Leeds. They were all over the place, on every pavement, and at times it was impossible to take a step without treading on them.” (Frank Haiste)

“During the plague of 1976, while on holiday at Minster, in Sheppey, everywhere one put one’s foot, it was thick with ladybirds. The posts along the sea-front holding up the chains were completely smothered.” (Brenda Madgwick)

“I remember the ladybirds of 1976 well. I then lived on the Norfolk coast, and used to take my dog for a walk along the sand each day. In 1976, for what must have been about six weeks, we daily had the company of millions and millions of ladybirds along the beach. The numbers appeared to fluctuate from day to day, but I guess the zenith was about the end of July, or perhaps early August. The numbers on the beach were quite extraordinary, and once the day got hot, many thousands were airborne. Eventually, we began taking our walk early in the morning so as to avoid the ladybirds when they were in flight. Remarkably, after this had been going on for many weeks, one day the whole lot just disappeared. I have no idea why, because, as far as I could see, the weather had not changed to any appreciable extent. One other

thing may be of interest. For most of the period when the ladybirds were about, the tide-line was solid with the corpses of dead ladybirds. I presume that these unfortunates had just drowned and been washed up." (John Trent)

"Beating trees and shrubs for moth larvae became a futile occupation in the latter part of the summer in 1976. After just one or two taps, the beating tray contained nothing but a seething mass of ladybirds. In Surrey, they were on almost every type of tree, with birch, oak, and willow perhaps being the worst. Several species were present. *Coccinella septempunctata* was by far the most abundant, but several other species were also very common. These included *Adalia bipunctata*, *Adalia decempunctata*, *Propylea quatuordecimpunctata*, *Coccinella undecimpunctata* and *Calvia quatuordecimguttata* which was particularly common on the birches. In over 25 years of moth collecting I cannot remember anything else like it. For several weeks, I have entered in my notebook for 1976, 'Ladybirds stopped work!.' (Stephen Moore)

"In the summer of 1976, on a humid and very hot night, I was on duty in the boiler house of the Maelor Hospital, Wrexham. The air was heavy with greenfly. A light breeze brought them in their millions causing them to sway one way, then the other. Huge numbers were drawn into the one boiler that was on stream. With a long brush I swept and shovelled them away throughout the night, until a dawn breeze wafted them away. The next night, or the one following, the same conditions applied, but this time it was the ladybirds that came, again in their millions, covering everything." (anon.)

"I have just heard you on the radio talking about ladybirds biting people when they are starving hungry. I was most interested to hear what you had to say, because I can confirm every word from personal experience. It was one year, back in the seventies, and from what you say, it sounds like 1976, in the school holidays. I had three young boys to amuse for six weeks, and because it was such a nice summer, every day seemed to be sunny, I promised the boys that I would take them to the seaside. I guess the first attempt was about the middle of July. We went off to Brighton, getting to the beach about 11 o'clock. By ten minutes later we were back in the car. Both Robert, my youngest, and I had several little bumps on our arms and legs from bites from ladybirds. They were absolutely everywhere, and thousands were in the air. They landed on us all the time, and when we got back into the car, we had to spend quite a while taking them off each other and out of our hair.

It was quite possible to feel when one bit us. It was a slight sort of pricking sensation, not much more than a light tickle, but after a minute or two, it began to sting and itch, so that it was quite unpleasant. We tried to do a few things around Brighton, away from the sea-front, which was pretty unpopulated because of the ladybird hordes, and ended up going to the pictures in the afternoon. Really a rather abortive day, but I do not think I have ever seen so many of one kind of animal together as I did that day.

In the next week, still trying to keep my promise to the boys, we tried again twice, once going to a spot near Hastings, and then trying the east coast at Frinton, but it was more or less the same story each time. In the end we gave up. I still like ladybirds as much as ever, but had long resented the fact that these objects of my affections had turned on me that year. Now that I know from your broadcast that they were starving to death, I can forgive those that took a bite out of me, and indeed, I feel rather sorry for them. It's a shame that they did not get anything nutritious out of me." (Angela Snow)

"The ladybird swarms of 1976 were not confined to the land. On occasion, my daughter and her husband reported sailing through seas that were completely covered in ladybirds." (Bridget Chadwick)

"On 11 July 1976, I was piloting a light aircraft about 20 miles south of Manchester at 1500 ft when I flew into a large swarm of ladybirds. It was like flying into bird shot. I put down at East Midlands airport to clean the canopy and check the air intakes. There were hundreds of the little creatures, alive, crawling all over the plane." (Signature illegible)

APPENDIX 2.

SOME OBSERVATIONS OF SWARMS OR EXCEPTIONAL NUMBERS OF LADYBIRDS RECORDED DURING THE CAMBRIDGE LADYBIRD SURVEY

11 June 1984. "Very large numbers of many species of ladybird on trees and shrubs near Santon Downham. Most were on broom, maple and Scots pine. Species included: *Anatis ocellata*, *Exochomus quadripustulatus*, *Adalia bipunctata*, *Coccinella septempunctata*, *Adalia decempunctata*, *Calvia quattuordecimguttata* and *Harmonia quadripunctata*, in descending order of abundance. Aphids were very abundant on the trees and many of the ladybirds were mating." (Peter Kearns and Simon Albrecht)

February 1985. "On Lakenheath Warren, exceptional numbers of pine ladybirds *Exochomus quadripustulatus* sunning themselves on pine trees. The majority were sitting still on pine cones in the sun. Some pine cones had as many as 30 ladybirds on them. Everywhere we looked, the pine trees had these ladybirds. As we walked for several miles through pine woods, the number of pine ladybirds must have run into many millions." (Heather Ireland)

May 1987. "Along the banks of the River Aire, West Yorkshire, thousands and thousands of ladybirds on the undergrowth and particularly on nettles." (Hazel Dunning)

Mid-May 1989. "A large drift of ladybirds appeared on a beach at Bude, Cornwall." (Ian Cobbledich)

June 1989. "On the ferry from Harwich to Esbjerg, Denmark, the boat was covered in thousands of ladybirds. Many of them were dead." (Mrs G. Stoller)

4 August 1989. "Between 15.30 and 16.15 hrs a mass migration of *Coccinella septempunctata* took place, flying from east to west at altitudes from ground level up to 50–60 ft at Little Stambridge Hall, near Rochford, Essex (TQ887919). Estimated to have involved many hundreds." (Observer—L. Watts, reported by Roger Payne)

An extract from the 1989 *Annual report of the Norfolk Ornithologists Association*, communication by Alan Paine read as follows. "Ladybird: swarms on 20 July, flying east from 11 a.m. to 1 p.m. and again later in the afternoon".

Three years later I received a pair of linked reports from the same source. The 1992 *Norfolk Ornithologists Association Report*, again sent in by Alan Paine, described events that took place at Holme, Norfolk. "One of the largest swarms of hoverflies that I have ever seen started to arrive on 31 July and continued the next day until 1.30 p.m., in ever-increasing numbers, all flying non-stop down a south-westerly wind. Together with ladybirds, the mixed hordes meant a retreat to the HBO Centre

with door and windows firmly shut! 'Hundreds' even reached North Sea oil-rigs on 16 August and again 12 September."

And later, "Large swarms of 7-spot ladybird downwind (with hoverflies) on 31 July reaching a peak next day between 2 and 4.30 p.m., when flower spikes of marram grass were festooned. A few continued to arrive on 2 August and there were swarms everywhere. Some were so hungry they were eating hoverflies and their dead companions".

"The summer of 1989 was spectacular for ladybirds at Bettystown, near the mouth of the river Boyne, on the east coast of Ireland. There were literally thousands to be seen each day on the local golf course, and nobody locally could remember a more prolific year. In the memories of my children, 1989 will always be referred to as the ladybird summer." (Hugh Leech)

In the spring of 1990, we received reports of exceptional numbers of ladybirds from many parts of Britain. To give just a few examples: F. M. Unsworth reported from Hexham, Northumberland, "large numbers of ladybirds on open peat of previously burned moorland"; H. Bremner, from Biggin Hill, Kent, "thousands of ladybirds in my garden"; L. Owen, from Kirriemuir, Angus, noted "a great many ladybirds, all 7-spots, on our lawn"; C. Hurcombe, from Caversham, Berks., "I have a plague of ladybirds in my garden"; from Stamford Bridge, H. Goodwin reported "large numbers in garden, rose stems encrusted with the beetles, clusters of ladybirds hidden just underneath the topsoil throughout the front and back gardens"; and from Catherine Brown in Wigan, "last weekend thousands of ladybirds were basking in the sunshine of our south facing garden".

17 March 1990. "While on a walk on the North York Moors, I came across a swarm of ladybirds. They were in dense clusters all over the ground between low stunted heather bushes (*Calluna vulgaris*) no more than 4 ins in height." (J. Salter)

17 April 1990. "Astounding numbers of ladybirds all over the garden and surrounding area (alt. 750 feet) this spring. Location: Far-Ben, Dunsmore, Wendover, Bucks." (V. Piery)

Late July 1990. "A large plague of ladybirds, mainly 7-spots, at Weston-Super-Mare." (P. Lenin). This swarm was noteworthy enough to be mentioned in the *Daily Mail*.

Summer 1991. "Noticed 1000+ 7-spot ladybirds gathering on a concrete wall adjacent to the River Thames at Cliffe Marshes, Kent. Many were mating. A kestrel was sitting on the wall, possibly eating ladybirds." (Dr L. Love)

8.00 p.m., 7 August 1991. "Rushen Gout, North of Aust (ST582906): many thousands of 7-spots on the nationally scarce grass *Alopecurus bulbosus* on grazed saltmarsh beside the River Severn." (M. Kitchen)

21 April 1992. At Leigh (TQ5646): "Literally hundreds of 2-spot ladybirds in every crack and crevice on a telegraph pole, in the middle of a field. They appeared from about one foot off the ground, to a height as far as I could observe. One week later they had all disappeared." (Vic Measday)

Several recorders sent me the same cutting from the *Eastern Daily Press* of 28 July 1994. Under the headline "Basher barnee bee army breezes in. Holidaymakers took to their heels yesterday as a red army blew into town. The Norfolk seaside town of Wells was so over-run by an invasion of ladybirds that tourists and locals were driven inside to escape. In places the town looked prepared for a royal visit—with an

unblemished carpet of red bishee barnee bees (as ladybirds are called locally) covering the roads and pavements. Barry Franklin, from Derby, said: 'I've never seen anything like it. They're all over the place, you just can't escape them. I don't usually mind ladybirds, but this is just making me uncomfortable'. And Jane Hood, from Clacton, said: 'My two young children are sitting in the car because they're frightened, and we're about to get away from Wells'."

Late July–early August 1994. "2–3 mile stretch on the coast between Heacham and Hunstanton. Thousands flying everywhere. On a 16-metre long section of sea wall, 13 000, mainly 7-spots, were counted." (Richard Rockcliffe)

5 August 1994. At Hunstanton: "I parked my car near the Old Lighthouse. On the ground were very many stationary 7-spot ladybirds (20–40 per square foot of turf or tarmac). Later, walking back towards town, I found ladybirds as thick as chipping on a newly dressed road. There could have been a million." (H. Shelton)

From *The Bristol Evening Post*, 9 August 1994. "A village near Bristol has been invaded by a swarm of ladybirds. The streets of Severn Beach are running red with tens of thousands of the insects. Villagers said it is the largest invasion since the drought year in 1976."

Alan Paine reported reading, on the board of sightings at the Landguard Nature Reserve/Bird Observatory for 14 August 1994: "Huge arrival of ladybirds". No indication of numbers or species was given.

In addition we received these reports of events before the Survey.

"I remember visiting our small coastal town of Southwold when I was five years old (1964), and the car, us, and all in this one spot by the sea were covered with ladybirds." (Carmela Robinson).

May/June 1982. "While on holiday in France, at Sables d'Or, Brittany, we saw at the edge of the sea, coming in on the tide and walking up the beach, rows and rows of ladybirds. They were on the water being washed in, and many had managed to walk quite a distance up the beach (opposite to the lemming syndrome)." (Gillian Siddy)

SHORT COMMUNICATION

Leiophora (Arrhinomyia) innoxia (Meigen) (Diptera: Tachinidae) parasitizing the ground-hopper *Tetrix undulata* (Sowerby) (Orthoptera: Tetrigidae).—I collected an adult female *Tetrix undulata* (Sowerby) and a larva on Arbrook Common, Esher, Surrey on 6.v.1992 and retained them isolated in individual containers with a view to photography. The female died c. 10.v and a dipterous puparium was noted in the container shortly afterwards. A male *Leiophora innoxia* Meigen emerged 25.v.1992. No exit hole was visible; the neck membrane was intact. Presumably the parasite emerged from under the pronotal extension above the abdomen. The similarity of this structure to a beetle's elytra may have some bearing on why a parasitoid previously recorded from the flea beetles *Halticus* should attack a ground-hopper.—R. W. J. UFFEN, 4 Mardley Avenue, Welwyn, Hertfordshire AL6 0UD.